IMPLEMENTATION PLAN FOR
THE UPDATED NIDCR STRATEGIC PLAN 2003-2008
DRAFT – 09/06/2005

RESEARCH OPPORTUNITIES

About the Implementation Plan.

The Implementation Plan is derived directly from the NIDCR Strategic Plan (http://www.nidcr.nih.gov/AboutNIDCR/StrategicPlan/default.htm) and it serves as a template for guiding the Institute in developing specific initiatives on an annual basis. The organization of the Implementation Plan is tied closely to the goals and subgoals of the NIDCR Strategic Plan and each of the following sections is organized around the goals and subgoals of the Strategic Plan. Following a statement of a goal and sub-goal we have listed the recommendations for implementation for the stated goal and sub-goal for each of the scientific areas of the Institute. The scientific basis underlying the priorities is detailed in the "Burden of Disease" section of the NIDCR Strategic Plan. Additional information on disease morbidity of oral and craniofacial diseases and disorders is detailed in the Surgeon General's Report on Oral Health (http://www.nidcr.nih.gov/AboutNIDCR/SurgeonGeneral/default.htm).

The Implementation Plan was developed with broad input from the extramural research community, from intramural scientists, and from NIH staff. For each programmatic area, staff initially performed an analysis of gaps and scientific opportunities in the existing portfolio. Following these analyses, ten separate working groups covering each programmatic area were convened. Participants included members of National Advisory Dental and Craniofacial Research Council, members of the Board of Scientific Counselors, scientific content experts, and NIDCR program staff. The working groups arrived at a series of recommendations and priorities that were summarized in an executive summary for each area. In addition, a separate meeting was convened with an international panel of experts to discuss scientific opportunities for NIDCR in oral mucosal immunology. Finally, a one-day meeting on research training and career development was convened featuring speakers from the National Academies, the National Science Foundation, the Howard Hughes Medical Institute and representatives from other NIH Institutes and the Office of the NIH Director. Subsequently, staff analyzed the recommendations from all of these working groups and meetings and established the priorities that ultimately gave rise to the present plan.

The Implementation Plan should be viewed as a living document that will be amended as new research opportunities and technologies emerge and thereby alter the current list of priorities. Moreover, although the priorities detailed in this implementation plan are important to the mission of the NIDCR at this time, we will continue to rely on the imagination, ingenuity and innovation of individual scientists in our community to bring forward exciting new scientific opportunities.

Given the importance of biomedical research in fighting disease and improving the nation's health, the enormous range of possible subjects of research, and the thousands of

talented investigators who seek funding, NIH Institutes must make difficult choices about how to spend resources. This Implementation Plan and the preparatory activities described in the Introduction contribute to NIDCR's ongoing long range planning activities that chart the Institute's future in roughly five-year cycles. However, both planning and priority setting occurs in a larger context, including areas of emphasis determined by Congress, the Department of Health and Human Services, and NIH; a highly refined peer review process; and the annual congressional appropriation. The areas NIDCR chooses to emphasize in its solicited extramural and intramural research are selected through long-term and short-term science planning. Planning activities such as the Institute's annual process to develop research initiatives for a given fiscal year relies on information from a number of different sources and key external stakeholders. These individuals and organizations include:

- The extramural scientific community, including both individual researchers and professional societies;
- Patient organizations and voluntary health associations that may deal directly with the NIDCR or indirectly through Congress and the public media;
- The Congress and the Department of Health and Human Services;
- The National Advisory Dental and Craniofacial Research Council and the Board of Scientific Counselors;
- Other NIH Institutes, program offices, and other federal agencies;

In addition, the institute relies on input gleaned through ad hoc advisory groups and a variety of conferences and workshops. These include collaborative, trans-Institute and trans-NIH scientific conferences and workshops that constitute reviews of emerging scientific opportunities, public health concerns, or state-of-the-science assessments, many of which outline specific areas of research that should be the target of future initiatives or activities. Consensus development conferences also may be held. Finally, NIDCR uses information developed from evaluation research to identify areas that need additional resources and those which could be de-emphasized.

About the Institute and it's Scientific Programs.

The mission of the NIDCR is to support and conduct research and research training aimed at improving the oral health of the American people. The oral cavity with its teeth and supporting structures is, at the same time, located in one of the most structurally, functionally and developmentally complex regions and one of the most accessible organ systems of the body. Moreover, in addition to the diseases and disorders that affect this region, the face and the craniofacial structures play a significant role of the image of self and the relationship among human beings. For these reasons, our core mission includes a variety of disparate normal and pathological processes which often have little more in common than the same regional location. Thus research ranging from dental caries to oral and pharyngeal cancer; from chronic orofacial pain to Sjögren's Syndrome; from herpetic and aphthous ulcers to loss of teeth; from periodontal diseases to cleft lip and palate all fall within the mission of the Institute. This diversity of disease and developmental patterns and the underlying complexity of the structures in which they develop, is reflected in the varied programmatic areas and disciplines addressed in this

implementation plan.

It is becoming increasingly apparent that oral health is deeply integrated with general health; that oral diseases and conditions affect general health and that systemic diseases often display oral manifestations that require treatment or intervention. Often the approaches and specific initiatives we propose are integrated with and supported by those of other NIH Institutes and Centers.

Goal 1. Advance the understanding of the normal and abnormal processes underlying oral, dental and craniofacial diseases and disorders through the development and application of new technology and research tools.

Genetics, Structure and Function of Oral Tissues and Cells

Subgoal A: Support studies that address the genome, the transcriptome and the proteome of dental, oral and craniofacial diseases and disorders.

Craniofacial Developmental Biology and Mineralized Tissue Research

- Identify global and site-specific genes, transcripts and proteins of transcription factors, morphogens, growth factors, cytokines, and their receptors and signaling networks in craniofacial development.

- Define the gene-gene, and protein-protein interactions that result in normal and abnormal craniofacial development, including syndromic and non-syndromic clefting.

- Develop organ culture and animal experimental models that permit a detailed assessment of craniofacial normal and abnormal development, including the function of individual genes, proteins and gene-gene and protein-protein interactions.

- Identify and clarify the individual and coordinate function of genes, gene products, minerals and other factors that orchestrate the formation and biomineralization of bone, dentin, enamel and cementum.

- Identify embryonic and post-natal stem cells, their normal cell fate in craniofacial developmental biology, and the range and limit of their differentiation potential ("stemness").

Oral and Pharyngeal Cancer

- Define the genetic changes and alterations in molecular networks and signaling

pathways that lead to pre-malignancy and to the transition between pre-malignant and malignant lesions.

- Explore the role played by human papilloma virus -16 and -18 in development of oral and pharyngeal cancers in individuals without known risk factors such as alcohol, tobacco, and age.

- Support research aimed at defining the molecular mechanisms and pathological processes underlying treatment complications such as mucositis and osteoradionecrosis, and devise preventive and therapeutic approaches to ameliorate the severity of these side effects.

Salivary Gland Research

- Rapidly complete the Salivary Proteome Project that will identify all proteins secreted by salivary glands, thus providing a base line for proteins normally present in saliva.

- Determine the role and function of newly discovered salivary proteins as an extension of the Salivary Proteome Project.

- Identify the quantity, location, role and function of salivary gland stem cells.

- Determine whether salivary gland stem cells are among the first to be destroyed in the process of disease or radiation, and if not, whether they can be stimulated to regenerate ductal or acinar cells, or indeed the entire gland.

- Support genetic studies on Sjögren's Syndrome using the cohort of pre-Sjögren's Syndrome patients being enrolled in the international Sjögren's registry as well as other clinical trials.

- Develop new animal models of Sjögren's Syndrome. Explore the possibility of generating new strains of mice by transplantation of human salivary tissues, both normal and diseased, into immunodeficient strains.

Communication Within, Between and Among Cells

Subgoal B: Support research to understand the molecular mechanisms of cell signaling related to the development and progression of oral, dental and craniofacial diseases and disorders.

Craniofacial Developmental Biology and Mineralized Tissue Research

- Define and describe in molecular details the functional and mechanistic relationships and communication patterns among neural crest cells, mesodermal

and epithelial cells in forming the tissues of the craniofacial region.

- Characterize the mechanisms by which craniofacial bones undergo repair following craniofacial injury, trauma, and reconstruction.

- Characterize how craniofacial bone repair and remodeling achieves optimum bone quality. Characterize the contribution of mechanical forces, such as distraction osteogenesis, and the molecular mechanisms by which such forces modulate the rate, extent and quality of bone repair.

- Characterize the molecular and cellular mechanisms of osseointegration and bone augmentation.

Microbial-Microbial Communication Within Biofilms

- Characterize microbial-microbial signaling and to identify those that are important for assembly and disassembly of oral biofilms.

- Support studies that exploit quorum sensing and related mechanisms through development of small molecule reagents such a homoserine lactones and related compounds to turn off of expression of pathogenic genes and eventually disassemble the biofilms.

- Explore biomimetic principles to construct antimicrobial and self-cleaning coatings that disrupt or prevent biofilm formation.

- Improving existing, and develop novel approaches to manage or eliminate biofilms in water lines in dental offices.

Pain and Neuroscience Research

NIDCR Pain and Neuroscience Research interfaces with two important NIH-wide initiatives. One is the NIH Pain Consortium composed of representatives of NIH Institutes and Centers that support pain research and is under the leadership of NIDCR, the National Institute of Neurological Disorders and Stroke (NINDS), and the National Institute for Nursing Research (NINR). A second program, the NIH Blueprint for Neuroscience Research, is a new initiative formed by 15 Institutes and Centers that will fund large neuroscience research projects at NIH.

- Identify the genetic basis of human orofacial pain conditions.

- Identify the organizing principles that govern the behavior of neurons as well as glial cells and associated sensory and muscle cells.

- Determine where in the nociceptive system the body's unique endogenous anti-nociceptive systems are located. Establish where and by what mechanisms the

endogenous systems of orofacial pain control are facilitated, activated, or inhibited, i.e. characterization of neuromodulatory circuits.

- Support research into specific drug target genes employing pharmacologic or gene therapeutic approaches that target various modalities in the nociceptive cascade.

- Explore cortical-behavioral mechanisms that operate in response to the orofacial pain experience. Explore thalamo-cortical interactions to learn more about facial movements and alterations in movements associated with orofacial pain.

- Study motor activity in association with orofacial pain and cortical-behavioral mechanisms in humans and in animals.

Microbial Pathogenesis and Immunology

Subgoal C: Support research on the structural and functional properties of biofilms and biofilm-mediated diseases.

Creating an Atlas of Oral Biofilms

- Identify the entire oral microbiota including novel species and strains that have never been identified by classical culture techniques. Generate a complete inventory of microbial genomes in the oral cavity and identify new or novel genes whose function can subsequently be explored.

- Conduct a comprehensive comparison of the microorganisms and complex groups of microorganisms that are associated with health and disease.

- Generate a comprehensive library of probes, antibodies and small molecule reagents to identify *in situ* the microbial species of biofilms at various locations, the genes they express and the proteins they synthesize.

- Conduct studies based on real time imaging *in vivo* of microorganisms, specific genes and specific gene products of oral biofilms in humans to resolve in time and space the interactions between various species that lead to biofilm formation.

HIV/AIDS Research

- Elucidate the anti-HIV defense mechanisms in the oral cavity, including factors in saliva, in the resident microflora, and in host cells that enhance defenses against viral pathogens.

- Explore the routing of HIV in the oral cavity in newborns and throughout life and capture the fate of the virus in the oral cavity prior to seroconversion; describe how healthy tissues and the microflora respond to the virus.

- Determine the range of oral factors that might influence maternal child transmission during lactation.

- Study the pathogenesis and natural history of oral complications of HIV infection, including human papilloma virus and other oral viral pathogen-associated complications, aphthous ulcers, and more recently identified syndromes such as diffuse infiltrative lymphocytosis syndrome (DILS).

- Study the etiology and pathogenesis of oral lesions that may be related to HIV therapy.

- Study the development and validation of novel, alternative treatment and prevention strategies.

Innate and Adaptive Immunity; Oral Mucosal and Systemic Immunity

- Identify the protective or destructive mechanisms and responses of each arm of the immune system in oral health and disease.

- Explore whether there are common genes, or clusters of genes that distinguish commensals from pathogens.

- Determine the factors in saliva that facilitate or limit microbial colonization and disease development.

- Identify, define and characterize the genetic, cellular and molecular components of the oral mucosal immune system, and its relationship to global mucosal and systemic immune responses.

- Define and describe the ontogeny of human mucosal immunity and its evolution throughout human lifespan.

- Define the molecular basis for the severe immunosuppressive effects of oral and pharyngeal carcinomas.

- Develop immunotherapies that are effective in preventing or treating oral and pharyngeal cancers in high-risk groups.

- Identify in humans the specific destructive autoimmune mechanisms in oral and craniofacial diseases such as Sjögren's Syndrome.

Gene and Environment Interactions

Subgoal D: Support research to understand gene-disease associations, genes and gene products in normal craniofacial development, and gene-environment interactions in oral, dental and craniofacial diseases and disorders and birth defects.

- Identify environmental factors that raise or lower the risk of clefting and develop improved methods for diagnosis and prevention of clefting in human populations.

- Decipher in molecular terms the role of environmental and behavioral factors that increase or possibly lower the risk of developing oral and pharyngeal cancer.

- At the micro-environment level, describe in molecular detail the interactions between cells and extracellular matrix that result in embryonic and postnatal morphogenesis of the craniofacial regions, its tissues and teeth.

- Determine how stem cell phenotypes are regulated and controlled, and how these cells interact with other cells in an environment throughout the craniofacial region.

- Study tumor-environment interactions and how these interactions lead to oral and pharyngeal cancer initiation and progression, i.e. from pre-malignant to malignant, from non-invasive to invasive, or conversely, inhibit tumorigenesis,

Pharmacogenetics

Subgoal E: Understand individual variability of responses to drugs that are used for the treatment of dental, oral, and craniofacial diseases and disorders to develop highly effective, low-toxicity drugs or agents.

- Support research that addresses chronic orofacial pain particularly treatments for temporomandibular joint diseases and disorders.

- Support research on genetic differences in pain sensitivity and response to analgesics in man and animals, and gender differences in response to opiate-based drugs.

- Support pharmacogenetic studies on xerostomia that often accompanies use of anti-depressants and some heart medications that need to be taken for long periods or over the lifetime.

- Develop and validate new animal models for use in pharmacogenetic studies.

- Develop cooperation with scientists in pharmaceutical companies to study the oral effects of new drugs.

- Support research into the pharmacogenetics of dental fluorosis and other possible adverse effects of local or systemic use of flurorides in caries prevention.

Biocompatible Materials

Subgoal F: Support and encourage research for the design and development of "living" materials for the repair and regeneration of orofacial tissues and organs based on advances made in biological systems research.

Conventional Restorative Materials

- Develop and validate new technologies and analytical techniques that permit refinement of the assessment of possible adverse health effects of dental amalgam.

- Determine the possible neurotoxic effect of low levels of mercury vapor (Hg^0) in general and the effect of low levels of Hg^0 *in utero* on brain development in particular.

- Evaluate reproductive and pregnancy outcomes in large groups of oral health professionals with well-defined Hg^0 exposure.

- Continue to support research that can address the possible adverse health effects of other restorative materials used in the oral cavity such as composites, nanocomposites, ceramics, and titanium.

Novel Restorative Materials and Tissue Engineering

- Design and develop new dental restorative materials with superior bio-compatibility and function.

- Design and develop "smart" polymers that mimic the extracellular matrix in serving as scaffolds for parenchymal and stem cell transplantation.

- Develop biomimetic polymers with specific, selective biologic functions in adhesion, signaling, and growth factor activity to enable creation of inductive, permissive or restrictive local environments.

- Develop self-assembled nano-arrays as substrates for cell growth in a defined 3D environment. Support research to develop quantitative models to describe cell-cell, cell-matrix, and cell-polymer interactions.

- Develop engineering approaches for the elucidation of design principles of cellular systems. For example development of nanostructures (nanotubes, nanoparticles) that provide the capabilities of "synthetic stem cell niches" for controlling stem cell differentiation.

- Define the structural architecture and molecular interactions that specify organic-inorganic interfaces at all scale levels. Study the interface of oral tissues and

nanocomposites and develop and validate assays to assess the biocompatibility of new nanocomposite components.

- Develop delivery vehicles (nanoparticles, artificial matrices) capable of on-demand local delivery of precise amounts or regulatory molecules (growth factors, cytokines, pharmacologic agents).

- Develop micro-environments where cells can be precisely placed, manipulated and then analyzed in real time. Develop microfluidics networks that allow for real time study of cell-microbial and microbial-microbial interactions and movements.

- Link the Temporomandibular Joint Disorders Registry to the development of biological materials that can restore/regenerate the functional mechanical and anatomical properties of the tissues of the temporomandibular joint.

Industrial Relations to Accelerate Translation of New Paradigms in the Clinic

- Develop strategic initiatives to focus on translation and commercialization of projects and technologies in areas of greatest commercial impact and public health need.

- Establish consultation and liaisons with experts in the dental and biotechnology industries, investment community, academicians with credentials in inter- and multi-disciplinary projects.

Goal 2. Develop new or improved approaches and methods for preventing, diagnosing, treating and eventually eliminating oral, dental and craniofacial diseases and disorders.

Development and Validation of Biomarkers

Subgoal A: Develop and validate biochemical, cellular, physiologic, or genetic biomarkers that can be used to predict risk, aid in early diagnosis, and assess disease progression and response to treatment of chronic and disabling oral diseases and disorders.

- Develop and validate biosensors for diagnostic purposes. Develop less invasive sensors to measure molecular concentrations, associations and reactions in living cells. Develop a platform ("laboratory on a chip") based on multiple separation and detection technologies at sub-micron scales.

- Identify and validate biomarkers for dental caries and periodontal diseases with predictive accuracy to identify high-risk teeth, high-risk individuals and high-risk populations, and effective treatment outcomes.

- Develop and validate improved diagnostic criteria and validated biomarkers (e.g. genetic, neuroinflammatory, neuropathic) for temporomandibular joint disorders and other chronic orofacial pain conditions, and treatment outcomes.

- Develop and validate screening methodologies for premalignant and malignant lesions that can be applied in dental and medical practice settings and on a population basis in the general population and in selected high-risk populations. The emerging practice-based networks are envisioned to play an important role in the development and validation of such new technologies.

- Link the saliva proteome to the validation of the saliva-based diagnostics already under way.

- Develop more sensitive behavioral measures and biomarkers to elucidate linkages between behavior and physiology/pathology (e.g. improved, clinically relevant measurement of oral hygiene, tobacco use, dietary habits as linked to oral diseases).

Clinical Research and Clinical Trials

Subgoal B: Expand and enhance the Institute's clinical research and clinical trials program to identify effective preventive, diagnostic and treatment approaches for oral, dental and craniofacial diseases and disorders.

Caries and Periodontal Diseases

- Determine the contribution of genetic factors to the susceptibility and resistance to dental caries and periodontal diseases.

- Conduct human clinical intervention trials that will answer the question whether periodontal treatment and prevention significantly lowers the risk of developing any or all of the systemic complications reported in association studies (low-birth weight, preterm birth, cardiovascular disease, pulmonary disease, stroke, diabetes).

- Develop and validate new technologies for the early detection of enamel demineralization before cavitation to increase the efficiency and decrease the costs of caries clinical trials and facilitate new paradigms for the reversal and repair of early demineralization (RFA-DE-06-008).

- Understand the human pharmacokinetics of fluoride relative to caries prevention and to dental fluorosis.

- Assess whether the multiple sources of fluoride available today (water fluoridation, dentifrices, mouth washes, food chain, soft drinks) merit a

reevaluation of the current modalities of fluoride usage in caries prevention.

- Determine the role of specific microbial virulence factors, host microbial communication, and host immune responses in gingivitis. Conduct clinical studies in humans to identify factors that govern and regulate the host response to microbial colonization.

- Develop and test effective community and population-based methods of preventing periodontal disease.

- Develop and test innovative periodontal treatment strategies in humans that are minimally invasive, cost-effective and take advantage of the increased understanding of tissue regeneration and repair at the molecular level.

- Develop and test innovative, cost-effective and minimally invasive methods in humans for preventing and treating dental caries.

- Investigate outcomes of various treatment protocols, effects of systemic diseases on success rates, quality of life, patient preferences, and needs for individuals with osseointegrated dental implants and who have congenitally missing teeth or developmental disabilities (RFA-DE-06-007).

Pain and Neuroscience Research

- Supplement existing prospective studies of female populations with orofacial pain studies to determine the characteristics of individuals who go on to develop temporomandibular joint disorders.

- Compare and contrast orofacial pain with pain elsewhere in the body to determine if there are intrinsic, substantive differences reflecting, for example, specific "orofacial pain" genes. Conditions to be considered include temporomandibular joint diseases/disorders, atypical facial pain, atypical odontalgia, burning mouth syndrome, trigeminal neuralgia, and post-herpetic neuralgia.

- Determine, in cases where orofacial pain occurs in common with other comorbidities (such as temporomandibular joint disorders with fibromyalgia or irritable bowel syndrome, chronic fatigue syndrome), whether a common construct or trigger underlies the comorbidities.

- Conduct genetic/molecular epidemiology cohort studies of temporomandibular joint disorders patients with matched controls to search for patterns of gene expression that may distinguish the groups, and to identify subgroups of patients within the temporomandibular joint disorders population.

- Determine feasibility of ablating dorsal root and trigeminal ganglion neurons for long-term pain control and the mechanisms involved.

- Develop and validate of objective outcome measures to judge the efficacy of orofacial pain therapies in clinical studies and clinical trials.

Salivary Gland Research

- Develop and validate approaches to restore impaired salivary gland function in humans through gene transfer approaches.

- Develop and validate approaches to utilize salivary glands as bioreactors in humans to restore deficiencies of certain proteins by secretion to the systemic circulation (insulin, human growth hormone).

- Develop and validate the next generation of vectors suitable for gene transfer to human salivary glands.

Population-Based, Genetics, Social and Behavioral Research

Subgoal C: Support studies that expand and enhance the integration of population-based, genetic, social, and behavioral research.

- Explore in depth the behavior of animals and humans affected by chronic orofacial pain for a more comprehensive understanding of the experience of pain, using modern molecular and imaging tools.

- Investigate the behavioral manifestations of conditions of orofacial chronic pain in animals and human subjects.

- Investigate environmental influences on the experience of orofacial pain. Relatively little is known about the role of environmental stressors as related to onset and fluctuations in the pain experience.

- Incorporate reliable behavioral and social science outcome measures wherever appropriate in dental/oral clinical research and clinical trials.

- Use the NIDCR Practice Based Networks as a vehicle to incorporate behavioral and social science approaches to assessment, intervention, or outcome measurement within dental practice.

- Conduct behavioral research to understand and enhance translation and adoption of new clinical research findings in oral health into routine health care delivery.

- Support research that examines the influence of disease on behavior (examples include: orofacial pain, toothaches, edentulism)

- Clinical health endpoints in randomized controlled clinical trials are typically cast

in terms of morbidity or mortality but there is increasing interest in determining what happens to patients along other dimensions following an intervention. For example, it is important to know whether or not they feel better or whether they are satisfied or not with their treatment or whether their quality of life has improved. These are the goals of the Patient Reported Outcome Measurement and Information Systems (PROMIS) NIH Roadmap initiative. Explore how behavioral and social scientists studying oral, dental and craniofacial health and disease can contribute to this initiative by pretesting measures in general or specialty dental care settings or with populations having different dental disorders (e.g. orofacial pain, craniofacial disorders, periodontal disease).

RESEARCH CAPACITY

Goal 3. Ensure an adequate and well-trained research workforce that reflects the current and emerging needs of science and includes sufficient numbers of investigators from diverse disciplines and from underrepresented groups.

Goal 4. Support research infrastructure and enhance the development of new approaches for conducting inter- and cross-disciplinary research.

RESEARCH TRAINING AND CAREER DEVELOPMENT

- The NIDCR will maintain a diverse portfolio of individual and institutional research training and career development programs that address the needs of the community and guarantee optimal training conditions for those who wish to enter biomedical research as a career in academia or industry (see NIDCR training website: http://www.nidcr.nih.gov/Funding/Training/).

In addition to these ongoing support mechanisms, the NIDCR views it as a priority to explore innovative and imaginative new approaches in training wherever possible.

- Develop and support programs that enable dental schools to attract and recruit students from a scientific undergraduate field that already have exposure to and a continued interest in research.

- Continue to include targeted recruitment efforts toward women and underrepresented minorities (African Americans, Hispanics, Native Americans) and provide support mechanisms for innovative programs that attract these groups both to research and to dentistry.

- Support and encourage development of dual degree (DMD/DDS and PhD) Dentist

Scientist Training Programs (DSTP) in the nation's dental schools and provide tuition and stipend support for individuals enrolled in these programs.

- Support, encourage and further develop programs that allow science-interested dental students an opportunity to commit one full year for mentored clinical or basic research before returning and finishing their dental education. Work with individual dental schools and dental professional, educational and research organizations (ADA, ADEA, AADR) to facilitate such arrangements and to provide the requisite support.

- Continue support for multi- and interdisciplinary, comprehensive postdoctoral institutional training grants in addition to a variety of already existing individual awards.

- Continue funding and support for clinical research training for dentists under a variety of institutional and individual award mechanisms (http://grants1.nih.gov/grants/guide/rfa-files/RFA-DE-05-008.html).

- The NIDCR proposes, on an experimental basis, to build a program modeled after the Robert Wood Johnson Foundation Physicians Scholars Program and successfully implemented with the "Native Investigator Development Program" at University of Colorado Health Science Center's Resource Center for Minority Aging Research (RCMAR). The program, termed **"Distributive" Training Program for Junior Dental School Faculty,"** is based on a distributive approach where the trainees stay at their home institutions and receive training by a customized team of local or national mentors who guide and monitor trainee progress, so that their time away from the home institution is minimized. The didactic program is taught through a number of short 2-3 day mini-courses at a central location where all trainees and mentors have an opportunity to meet and interact. This initiative will create and support an experimental distributive postdoctoral training program for dental clinical faculty that aims at developing the trainees into independent scientists.

Evaluation and Tracking of Training and Career Development Programs

- While the success of individual training programs cannot be ascertained in the short term, it is imperative that the NIDCR work with the NIH to establish a detailed database on all trainees from institutional, as well as individual training and career development, support mechanisms, including information about the future career path and success of each trainee.

Infrastructure Improvement of US Dental Schools

- Support grants for infrastructure improvement for purchase of large equipment and recruitment of magnet and younger investigators in order to create a critical mass environment conducive to research (http://grants1.nih.gov/grants/guide/rfa-

files/RFA-DE-04-008.html). Such grants have currently been awarded to 7 dental schools that do not rank among the six highest NIDCR-funded schools. The support is for two years after a one year planning grant. Two similar grants were awarded to minority institutions.

- Support curriculum development grants aimed at incorporating research as an integral part of dental education (http://grants1.nih.gov/grants/guide/pa-files/PAR-02-144.html). Currently five such grants have been funded and new applications are being encouraged.

COMMUNICATION

Goal 5. Enhance the translation of research results into clinical practice and communicate science-based health information to ensure that NIDCR-supported research leads to improved health.

- Define the factors and strategies to increase the timely dissemination and implementation of research findings into dental practice.

- Determine the most effective means to translate new and existing knowledge of disease prevention and health promotion into public health practice and use by the public.

- Explore novel methods of disseminating information and skills to clinicians, patients and others in geographically isolated areas and those with ambulation problems through telehealth and teledentistry approaches.

- Improve the awareness and knowledge base in the population in general, and in high-risk populations in particular, of oral diseases and disorders and their risk factors.

- Provide dental health professionals with information to help them care for patients with systemic conditions that affect oral health, including developmental disabilities, cancer treatment, and diabetes.

- Increase medical professionals' awareness that prevention and management of oral complications of cancer treatment can enhance both patient survival and quality of life.

- Provide parents and caregivers practical, easy-to-understand information for preventing dental disease in children. Focus particularly on populations with oral health disparities and limited oral health literacy. Build new marketing partnerships with intermediaries such as community organizations, government

programs, health care providers and others to reach parents and caregivers.

- Provide researchers, educators, professional and scientific organizations and patient advocacy organizations with regular updates about the latest advances in oral health research and funding opportunities.

HEALTH DISPARITIES

Goal 6. Eliminate health disparities in oral, dental and craniofacial diseases and conditions among underserved populations and groups.

- Work with other Institutes and Centers and relevant Federal Agencies to develop scientifically based approaches to conceptualize race/ethnicity for health disparities research purposes to more accurately reflect the growing diversity in the U.S. population.

- Conduct epidemiological surveys of well-defined subpopulations to determine their oral and general health status in order to specify and address the nature of the health disparities found.

- Support novel and innovative, comprehensive interdisciplinary research approaches, supported by multilevel conceptual models and analyses, to understand and address the micro and macro level factors underlying oral health disparities among U.S. subgroups.

- Document the full range of determinants of health and disease within new waves of immigrants including those that arrive with excellent oral health as well as those with potentially detrimental practices such as the use of areca nut and paan.

- Utilize existing or develop new networks as vehicles for health disparities data collection, analyses and interventions as appropriate for accessing vulnerable populations including those with special needs. The Clinical Directors Network of Federally Qualified Health Centers and the NIDCR Practice Based Research Networks are two examples of existing networks.

- Partner with other research entities by incorporating an oral health component to prospective studies that would glean information on the broad array of factors that contribute to oral health disparities.

- Conduct interdisciplinary studies to explore the linkages between genetics and other biological pathways including environment, culture, and behavior across the life course and develop interventions that take advantage of these linkages.

- Conduct studies to elucidate why individuals from the same racial/ethnic group and cultural backgrounds have different health profiles and more or less health disparities, depending on the "local culture" and develop appropriate interventions.

- Develop and validate novel approaches to understanding "culture" as an asset in improving oral health literacy, oral health practices and behaviors.

- Increase the enrollment and retention of women, children, and racial and ethnic minorities and other underrepresented groups in NIDCR-funded clinical research including intervention studies specifically designed to eliminate health disparities.

- Stimulate research that utilizes the community-based participatory research approach that works directly with leaders and agencies inside communities with high needs to assure that representatives are included in all phases of research development and conduct.

- Engage allied oral health professionals including those from the study communities as a source of research personnel and actively develop opportunities for advanced studies, research training and mentoring, to increase the cadre of health disparities researchers.

DATA ACQUISITION AND ANALYSIS

Goal 7. Ensure the adequacy of systems to document and monitor the extent and impact of oral, dental and craniofacial diseases, disorders and conditions.

- Periodically assess the need for surveys, and design and conduct such surveys as are required to understand the extent and impact of oral, dental, craniofacial diseases and disorders.

- Develop strategies for follow-up with the ongoing NHANES taking into account existing studies such as the Hispanic Community Study.

- Support the development of new methods for diagnosing and monitoring dental caries and periodontal diseases.

- Support the inclusion and integration of oral health activities (interview, examination, and/or self-report) in national surveys or in other longitudinal studies at the national, state, regional or community level.

- Support research that evaluates the use of new technologies and approaches for

use in clinical and community trials, and population surveys.

- Conduct studies and analyses of existing data on burden of illness of oral, dental and craniofacial diseases and disorders, such as with the National Center for Health Statistics and the National Health Interview Survey, to include data on cost of services and health care utilization.

- Establish ongoing access for researchers to existing data and ready analysis to serve as a basis for hypothesis generation and for development of new surveys to address gaps in knowledge.

- Continue collaborations with and/or support of the Data Resource Center and Query System.

- Support analyses of access to care, cost of care, and utilization data in the Medical Expenditure Population Survey and other public oral health databases.

NIDCR Evaluation

Evaluation research is an important tool to assist NIDCR with planning, management, and accountability. At the Institute, evaluation is defined as objective, systematic research that uses scientific criteria and analytical techniques to measure the effectiveness of program implementation and/or the impact of program results. As with NIDCR's biomedical research, priority setting is needed for evaluation research due to limited resources. The results of NIDCR evaluations are used in future short- and long-term planning and management.

Comprehensive evaluations are conducted for key disease-based and crosscutting areas of NIDCR's portfolio of research and activities. The order in which the areas are selected for evaluation is determined by applying six criteria: (1) prevalence of diseases or conditions relevant to the area; (2) the impact of the underlying condition or problem; (3) NIDCR resources devoted to the area; (4) timing—for example, whether sufficient time has passed to see the impact of a particular initiative or effort; (5) resources needed to conduct the evaluation; (6) recommendations of Council and other advisory groups.

Evaluations have been completed recently or are ongoing in the areas of dental caries, periodontal diseases, health disparities, and craniofacial anomalies. Smaller-scale analyses are also conducted. For example, publication-based reviews and analyses have been conducted in preparation for competing renewal for centers and other large-scale grants. For each evaluation, a set of research questions and objectives are developed. Some of these objectives will reflect the unique nature of each portfolio, but others are designed to permit comparisons across topic areas.

Panels of nationally and internationally known scientists often assist NIDCR in conducting these studies. For example, for the evaluation of NIDCR's dental caries

research portfolio, a technical advisory panel helped identify specific analyses needed to describe the scientific literature and NIDCR's grant portfolio, pointed out recent interventions and discoveries in the field, and provided context to the key findings of the study.